METHOD 513.5

ACCELERATION

NOTE: Tailoring is essential. Select methods, procedures and parameter levels based on the tailoring process described in Part One, paragraph 4, and Appendix C. Apply the general guidelines for laboratory test methods described in Part One, paragraph 5 of this standard.

1. SCOPE.

1.1 Purpose.

The acceleration test is performed to assure that materiel can structurally withstand the steady state inertia loads that are induced by platform acceleration, deceleration, and maneuver in the service environment, and function without degradation during and following exposure to these forces. Acceleration tests are also used to assure that materiel does not become hazardous after exposure to crash inertia loads.

1.2 Application.

This test method is applicable to materiel that is installed in aircraft, helicopters, manned aerospace vehicles, air-carried stores, and ground-launched missiles.

1.3 Limitations.

1.3.1 Acceleration.

As addressed in this method, acceleration is a load factor (inertia load, "g" load) applied slowly enough and held steady for a period of time long enough such that the materiel has sufficient time to fully distribute the resulting internal loads, and such that dynamic (resonant) response of the materiel is not excited. Where loads do not meet this definition, more sophisticated analysis, design, and test methods are required.

1.3.2 Aerodynamic loads.

Materiel mounted such that any or all surfaces are exposed to aerodynamic flow during platform operations are subject to aerodynamic loads in addition to inertia loads. This method is not generally applicable to these cases. Materiel subject to aerodynamic loads must be designed and tested to the worst case combinations of these loads. This often requires more sophisticated test methods usually associated with airframe structural (static and fatigue) tests.

1.3.3 Acceleration versus shock.

Acceleration loads are expressed in terms of load factors which, although dimensionless, are usually labeled as "g" loads. Shock environments (methods 516.5 and 517) are also expressed in "g" terms. This sometimes leads to the mistaken assumption that acceleration requirements can be satisfied by shock tests or vice versa. Shock is a rapid motion that excites dynamic (resonant) response of the materiel but with very little overall deflection (stress). Shock test criteria and test methods cannot be substituted for acceleration criteria and test methods or vice versa.

2. TAILORING GUIDANCE.

2.1 Selecting the Acceleration Method.

After examining requirements documents and applying the tailoring process in Part One of this standard to determine where acceleration effects are foreseen in the life cycle of the materiel, use the following to confirm the need for this method and to place it in sequence with other methods.

2.1.1 Effects of acceleration.

Acceleration results in loads on mounting hardware and internal loads within materiel. Note that all elements of the materiel are loaded, including fluids. The following is a partial list of detrimental effects from high levels of acceleration. Expectation that any of these may occur will confirm the need to test for this occurrence.

a. Structural deflections that interfere with materiel operation.

b. Permanent deformation and fractures that disable or destroy materiel.

c. Broken fasteners and supports that result in loose parts within materiel.

d. Broken mounting hardware that results in loose materiel within a platform.

e. Electronic circuit boards that short out and circuits that open up.

f. Inductances and capacitances that change value.

g. Relays that open or close.

h. Actuators and other mechanisms that bind.

i. Seals that leak.

j. Pressure and flow regulators that change value.

k. Pumps that cavitate.

l. Spools in servo valves that are displaced causing erratic and dangerous control system response.

2.1.2 Sequence among other methods.

a. General. See Part One, paragraph 5.5.

b. Unique to this method. Conduct the high temperature test (method 501.4) prior to acceleration.

2.2 Selecting a Procedure.

This method includes three test procedures.

a. Procedure I – Structural Test.

b. Procedure II – Operational Test.

c. Procedure III – Crash Safety Test.

2.2.1 Procedure selection considerations.

Subject materiel to be tested to both Procedure I and Procedure II tests unless otherwise specified. Subject manned aircraft materiel that is located in occupied areas or in ingress and egress routes to Procedure III.

2.2.2 Difference among procedures.

2.2.1.1 Procedure I - Structural Test.

Procedure I is used to demonstrate that materiel will structurally withstand the loads induced by in-service accelerations.

2.2.1.2 Procedure II - Operational Test.

Procedure II is used to demonstrate that materiel will operate without degradation during and after being subjected to loads induced by in-service acceleration.

2.2.1.3 Procedure III – Crash Safety Test.

Procedure III is used to demonstrate that materiel will not disintegrate or be torn loose from its mounts by crash accelerations.

2.3 Determine Test Levels and Conditions.

The tests vary in acceleration level, axis of acceleration, duration, test apparatus, and on/off state of test item. Obtain acceleration values for individual materiel items from the platform structural loads analyses. When the applicable platform is unknown, the values of tables 513.5-I, 513.5-II, and 513.5-III and the following paragraphs may be used as preliminary test criteria pending definition of actual installation criteria.

2.3.1 Test axes.

For the purpose of these tests, the direction of forward acceleration is always considered to be the direction of forward acceleration of the platform. The test item is tested in each direction along three mutually perpendicular axes for each test procedure. One axis is aligned with the forward acceleration of the platform (fore and aft, X), one axis is aligned with the spanwise direction of the platform (lateral, Y), and the third axis is perpendicular to the plane of the other two axes (up and down, Z). Figure 513.5-1 shows the three linear and three rotation axes as typically defined for vehicle acceleration.

2.3.2 Test levels and conditions - general.

Tables 513.5-I, 513.5-II, and 513.5-III list test levels for Procedure I (Structural Test), Procedure II (Operational Test), and Procedure III (Crash Safety Test), respectively. When the orientation of the materiel item relative to the operational platform is unknown, the highest pertinent level listed in a table applies to all test axes.

2.3.3 Test levels and conditions - fighter and attack aircraft.

The test levels as determined from tables 513.5-I and 513.5-II are based on accelerations at the center of gravity (CG) of the platform. For fighter and attack aircraft, the test levels, must be increased for materiel that is located away from the vehicle CG to account for loads induced by roll, pitch, and yaw during maneuvers. When criteria are developed for specific aircraft, maneuver cases are considered and the resulting additional angular accelerations may add or subtract effects from the linear acceleration effects. When the following relationships (a-f) are used, it must be assumed that the load factors always add. Thus absolute values are used in the equations. Add the load factors derived below to the Operational Test (Procedure II) levels of table 513.5-II. Multiply the load factors derived below by 1.5 and add to the Structural Test (Procedure I) levels of table 513.5-I. Do not add these values to the Crash Safety Test (Procedure III) levels of table 513.5-III.

a. Roll maneuver, up and down test direction. The additional load factor (ΔN_Z) induced by roll, is computed as follows:

$$\Delta N_Z = (z/g)\,(d\,\phi/d\,t)^2 + (y/g)\,d^{\,2}\phi/d\,t^2$$

b. Roll maneuver, lateral left and lateral right directions. The additional load factor (ΔN_Y) induced by roll, is computed as follows:

$$\Delta N_Y = (y/g)\,(d\,\phi/d\,t)^2 + (z/g)\,d^{\,2}\phi/d\,t^2$$

c. Pitch maneuver, up and down test directions. The additional load factor (ΔN_Z) induced by pitch change, is computed as follows:

$$\Delta N_Z = (z/g)\,(d\,\theta/d\,t)^2 + (x/g)\,d^{\,2}\theta/d\,t^2$$

d. Pitch maneuver, fore and aft test directions. The additional load factor (ΔN_X) induced by pitch change, is computed as follows:

$$\Delta N_X = (x/g)\,(d\,\theta/d\,t)^2 + (z/g)\,d^{\,2}\theta d\,t^2$$

e. Yaw maneuver, lateral left and right test directions. The additional load factor (ΔN_Y) induced by yaw, is computed as follows:

$$\Delta N_Y = (y/g)\,(d\,\psi/d\,t)^2 + (x/g)\,d^{\,2}\psi/d\,t^2$$

f. Yaw maneuver, fore and aft test directions. The additional load factor (ΔN_X) induced by yaw change, is computed as follows:

$$\Delta N_x = (x/g)\,(d\,\psi/d\,t)^2 + (y/g)\,d^{\,2}\psi/d\,t^2$$

Where:

x = fore and aft distance of materiel from the aircraft CG, m (in)
y = lateral distance of materiel from the aircraft CG, m (in)
z = vertical distance of materiel from the aircraft CG, m (in)
g = acceleration of gravity, 9.81 m/sec^2 (386 in/sec^2)
ϕ = angle of rotation about the X axis (roll), rad
$d\,\phi/d\,t$ = maximum roll velocity in rad/sec (if unknown use 5 rad/sec)
$d^{\,2}\phi/d\,t^2$ = maximum roll acceleration in rad/sec^2 (if unknown use 20 rad/sec^2)
θ= angle of rotation about the Y axis (pitch), rad
$d\,\theta/d\,t$ = maximum pitch velocity in rad/sec (if unknown use 2.5 rad/sec)
$d^{\,2}\theta/d\,t^2$ = maximum pitch acceleration in rad/sec^2 (if unknown use 5 rad/sec^2)
ψ = angle of rotation about the Z axis (yaw), rad
$d\,\psi/d\,t$ = maximum yaw velocity in rad/sec (if unknown use 4 rad/sec)
$d^{\,2}\psi/d\,t^2$ = maximum yaw acceleration in rad/sec^2 (if unknown use 3 rad/sec^2)

2.4 Special Considerations.

a. Sway space measurements. If a piece of materiel is mounted on vibration isolators or shock mounts, perform the tests with the materiel mounted on the isolators/mounts. Measure the deflections of the isolators/mounts while the test item is exposed to the test accelerations. These data are needed to indicate potential interference with adjacent materiel, (i.e., define sway space requirements).

b. Acceleration simulation. Careful assessment of the function and characteristics of the test item has to be made in selecting the apparatus on which the acceleration tests are to be performed due to the differences in the manner in which acceleration loads are produced. There are two types of apparatus that are commonly used: the centrifuge and a track/rocket-powered-sled combination.

c. Centrifuge. The centrifuge generates acceleration loads by rotation about a fixed axis. The direction of acceleration is always radially toward the center of rotation of the centrifuge, whereas the direction of the load induced by acceleration is always radially away from the axis of rotation. When mounted directly on the test arm, the test item experiences both rotational and translational motion. The direction of the acceleration and the load induced is constant with respect to the test item for a given rotational speed, but the test item rotates 360 degrees for each revolution of the arm. Certain centrifuges have counter-rotating fixtures mounted on the test arm to correct for rotation of the test item. With this arrangement, the test item maintains a fixed direction with respect to space, but the direction of the acceleration and the induced load rotates 360 degrees around the test item for each revolution of the arm. Another characteristic is that the acceleration and induced load are in direct proportion to the distance from the center of rotation. This necessitates the selection of a centrifuge of adequate size so that the portions of the test item nearest to and furthest from the center of rotation are subjected to not less than 90 percent or more than 110 percent, respectively, of the specified test level.

d. Track/rocket-powered-sled. The track/rocket-powered sled test arrangement generates linear acceleration in the direction of the sled acceleration. The test item mounted on the sled is uniformly subjected to the same acceleration level that the sled experiences. The acceleration test level and the time duration at the test level is dependent upon the length of the track, the power of the rocket, and the rocket charge. The sled track generally will produce a significant vibration environment due to track roughness. Typically this vibration is significantly more severe than the normal in-service use environment. Careful attention to the attachment design may be needed to isolate the test item from this vibration environment. In performing Procedure II tests, the support equipment necessary to operate the test item is mounted on the sled and traverses the track with the test item. This requires the use of self-contained power units and a remote control system to operate the test item while traversing the track. Telemetering or ruggedized instrumentation is required to measure the performance of the test item while it is exposed to the test load.

TABLE 513.5-I. Suggested g levels for Procedure I - Structural Test.

Vehicle Category [1]		Forward Acceleration A (g's) [2]	Test Level: Direction of Vehicle Acceleration (See figure 513.5-1)					
			Fore	Aft	Up	Down	Lateral	
							Left	Right
Aircraft [3], [4]		2.0	1.5A	4.5A	6.75A	2.25A	3.0A	3.0A
Helicopters		[5]	4.0	4.0	10.5	4.5	6.0	6.0
Manned Aerospace Vehicles		6.0 to 12.0 [6]	1.5A	0.5A	2.25A	0.75A	1.0A	1.0A
Aircraft Stores Carried on:	Wing/ Sponson	2.0	7.5A	7.5A	9.0A	4.9A	5.6A	5.6A
	Wing Tip	2.0	7.5A	7.5A	11.6A	6.75A	6.75A	6.75A
	Fuselage	2.0	5.25A	6.0A	6.75A	4.1A	2.25A	2.25A
Ground-Launched Missiles		[7], [8]	1.2A	0.5A	1.2A' [9]	1.2A' [9]	1.2A' [9]	1.2A' [9]

[1] Use levels specified for individual platforms and locations on/in the platforms. Use the values of this table only if platform criteria are unavailable.

[2] Use levels in this column when forward acceleration is unknown. When the forward acceleration of the vehicle is known, use that value for A.

[3] For carrier-based aircraft, use 4 as a minimum value for A, representing a basic condition associated with catapult launches.

[4] For attack and fighter aircraft, add pitch, yaw and roll accelerations as applicable (see paragraph 2.3.3).

[5] For helicopters, forward acceleration is unrelated to acceleration in other directions. Test levels are based on current and near future helicopter design requirements.

[6] When forward acceleration is not known, use the high value of the acceleration range.

[7] A is derived from the propulsion thrust curve data for maximum firing temperature.

[8] In some cases, the maximum maneuver acceleration and the maximum longitudinal acceleration will occur at the same time. When this occurs, test the materiel with the appropriate factors using the orientation and levels for the maximum (vertical) acceleration.

[9] Where A' is the maximum maneuver acceleration.

TABLE 513.5-II. Suggested g levels for Procedure II - Operational Test.

Vehicle Category [1/]		Forward Acceleration A (g's) [2/]	Test Level — Direction of Vehicle Acceleration (See figure 513.5-1)					
			Fore	Aft	Up	Down	Lateral Left	Lateral Right
Aircraft [3/, 4/]		2.0	1.0A	3.0A	4.5A	1.5A	2.0A	2.0A
Helicopters		[5/]	2.0	2.0	7.0	3.0	4.0	4.0
Manned Aerospace Vehicles		6.0 to 12.0 [6/]	1.0A	0.33A	1.5A	0.5A	0.66A	0.66A
Aircraft Stores Carried on:	Wing/ Sponson	2.0	5.0A	5.0A	6.0A	3.25A	3.75A	3.75A
	Wing Tip	2.0	5.0A	5.0A	7.75A	4.5A	4.5A	4.5A
	Fuselage	2.0	3.5A	4.0A	4.5A	2.7A	1.5A	1.5A
Ground-Launched Missiles		[7/, 8/]	1.1A	0.33A	1.1A' [9/]	1.1A' [9/]	1.1A' [9/]	1.1A' [9/]

[1/] Use levels specified for individual platforms and locations on/in the platforms. Use the values of this table only if platform criteria are unavailable.

[2/] Use levels in this column when forward acceleration is unknown. When the forward acceleration of the vehicle is known, use that value for A.

[3/] For carrier-based aircraft, use 4 as a minimum value for A, representing a basic condition associated with catapult launches.

[4/] For attack and fighter aircraft, add pitch, yaw and roll accelerations as applicable (see paragraph 2.3.3).

[5/] For helicopters, forward acceleration is unrelated to acceleration in other directions. Test levels are based on current and near future helicopter design requirements.

[6/] When forward acceleration is not known, use the high value of the acceleration range.

[7/] A is derived from the propulsion thrust curve data for maximum firing temperature.

[8/] In some cases, the maximum maneuver acceleration and the maximum longitudinal acceleration will occur at the same time. When this occurs, test the materiel with the appropriate factors using the orientation and levels for the maximum (vertical) acceleration.

[9/] Where A' is the maximum maneuver acceleration.

TABLE 513.5-III. Suggested g levels for Procedure III - Crash Safety Test.[3]

Vehicle/Category	Test Level [1/]					
	Direction of Vehicle Acceleration (See figure 513.5-1)					
	Fore	**Aft**	**Up**	**Down**	**Left**	**Right**
All manned aircraft except cargo/transport						
Personnel capsule	40	12	10	25	14	14
Ejection seat	40	7	10	25	14	14
All other items [2/]	40	20	10	20	14	14
Cargo/transport						
Pilot and aircrew seats	16	6	7.5	16	5.5	5.5
Passenger seats	16	3	4	16	5.5	5.5
Side facing troop seats	3	3	5	16	3	3
Personnel restraint	10	5	5	10	3	3
Stowable troop seats	10	5	5	10	10	10
All other items [2/]	20	10	10	20	10	10

[1/] Use levels specified for individual platforms and locations on/in the platforms. Use the values of this table only if platform criteria are unavailable.

[2/] The intent of this test is to disclose structural failures of materiel that may present a hazard to personnel during or after a crash. This test is intended to verify that materiel mounting and/or restraining devices will not fail and that sub-elements are not ejected during a crash. Use for materiel mounted in flight occupied areas and/or which could block aircrew/passenger egress or rescue personnel ingress after a crash.

[3/] Test item function is not required following this test. Thus test items that are not suitable for other tests or field use may be used for this test. Test items should be structurally representative (strength, stiffness, mass, and inertia) of the production design but need not be functional. All contents (including fluids) designed to be carried in/on the materiel should be included.

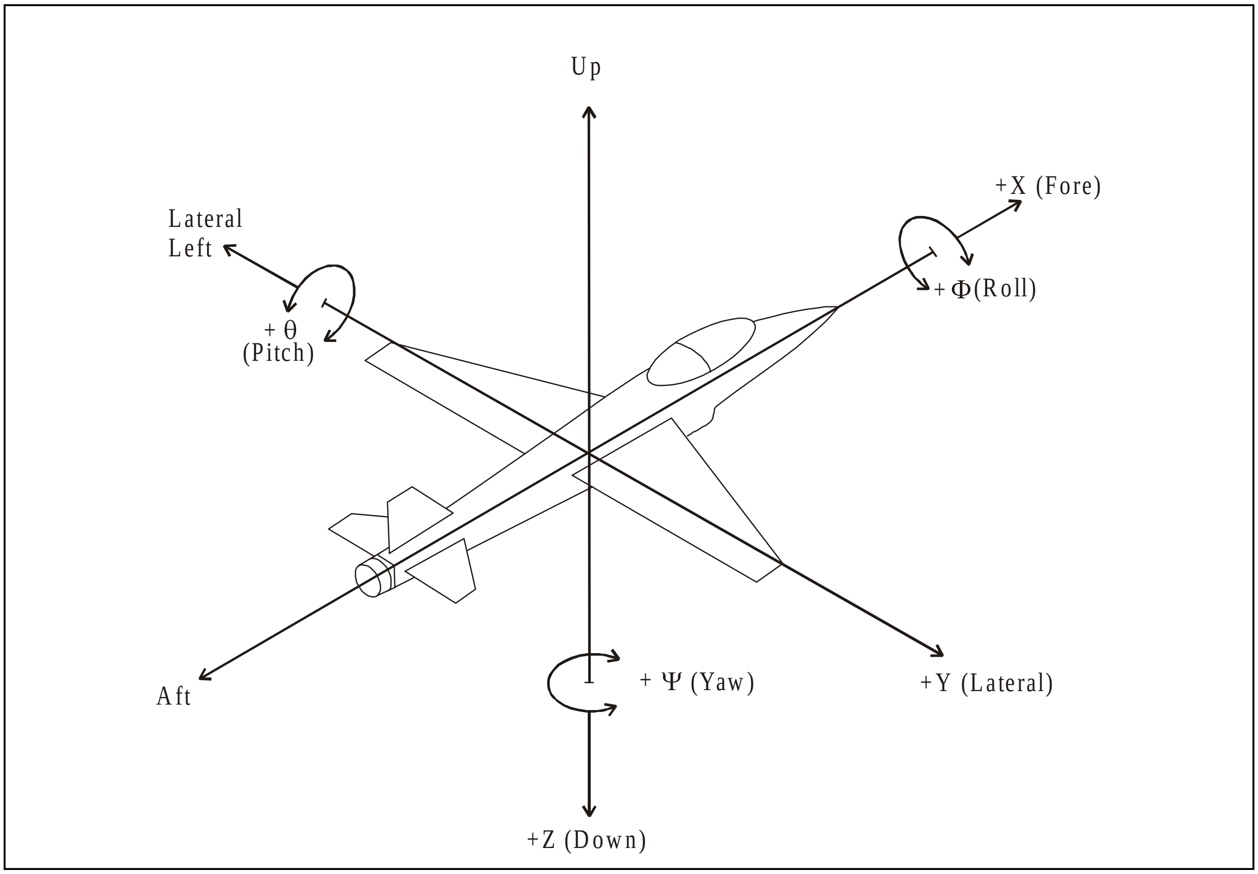

FIGURE 513.5-1. Directions of vehicle acceleration.

3. INFORMATION REQUIRED.

3.1 Pretest.

The following information is required to conduct acceleration tests adequately.

a. General. Information listed in Part One, paragraphs 5.7 and 5.9, and Part One, Appendix A, Tasks 405 and 406 of this standard.

b. Specific to this test method.

(1) Vector orientation of test item with respect to the fixture.

(2) Vector orientation of fixture with respect to direction of acceleration.

3.2 During Test.

Collect the following information during conduct of the test:

a. General. Information listed in Part One, paragraph 5.10 and in Part One, Appendix A, Tasks 405 and 406 of this standard.

b. Specific to this Method. Information related to failure criteria for test materiel under acceleration for the selected procedure or procedures. Pay close attention to any test item instrumentation and the manner in which the information is received from the sensors. For example, the acquisition of sensor signals from a test item on a centrifuge must consider either the way of bringing the sensor signals out through the centrifuge, a way of telemetering the sensor signals, or the effects of the acceleration on a recorder mounted on the centrifuge near the sensor for obtaining the sensor signals.

3.3 Post-test.

a. General. Information listed in Part One, paragraph 5.13 and in Part One, Appendix A, Tasks 405 and 406 of this standard.

b. Specific to this method.

(1) Vector orientation of test item with respect to the fixture.

(2) Vector orientation of fixture with respect to direction of acceleration.

4. TEST PROCESS.

4.1 Test Facility.

The required apparatus consists of either a centrifuge of adequate size or a track/rocket-powered-sled test arrangement. Recommend a centrifuge for all Procedure I (Structural Test), Procedure III (Crash Safety Test), and most of Procedure II (Operational Test) evaluations. Use a track/rocket-powered-sled test arrangement for Procedure II evaluations when strictly linear accelerations are required. In general, acceleration tests will not be instrumented. If there is need for test apparatus or test fixture/test item instrumentation, follow practices and procedures outlined in reference b. Verification of the correct input acceleration to the test item will be according to procedures established at the test facility.

4.2 Controls.

4.2.1 Calibration. Ensure any acceleration measurement for test verification have been made by instrumentation properly calibrated to the amplitude and frequency ranges of measurement.

4.2.2 Tolerances. Maintain the acceleration level between 90 per cent and 110 percent of the specified level over the full dimensions of the test item.

4.3 Test Interruption.

a. General. See Part One, paragraph 5.11, of this standard.

b. Specific to this method.

(1) If an unscheduled interruption occurs while the test item is at a specified test level, restart and run the complete test. If interruptions result in several new starts, evaluate the test item for fatigue damage. (Each application of acceleration is a single loading cycle. Duration of a loading cycle does not influence the severity of the test.)

(2) If the test item is subjected to acceleration loads in excess of the level specified for the test, stop the test, inspect the test item and perform a functional test. Based on the inspection and functional test, make an engineering decision as to whether to resume testing with the same test item or with a new test item.

4.4 Test Execution.

4.4.1 Preparation for test.

4.4.1.1 Inspections.

All items require a pretest standard ambient checkout to provide baseline data and additional inspections and performance checks during and after tests. Conduct inspections as follows:

Step 1. Examine the test item for physical defects, etc.
Step 2. Prepare the test item for test, in its operating configuration if required, as specified in the test plan.
Step 3. Obtain sufficient dimensional measurements of the test item to provide a reference guide for the evaluation of physical damage that may be induced during the tests.
Step 4. Examine the test item/fixture/centrifuge/sled combination for compliance with the test item and test plan requirements.
Step 5. If applicable, conduct an operational checkout in accordance with the test plan and document the results.
Step 6. Document the results.

4.4.1.2 Mounting of the test item.

Configure the test item for service application. Mount the test item on the test apparatus using the hardware that is normally used to mount the materiel in its service installation.

a. Centrifuge mounting.

Step 1. Determine the location for the test item by measurement from the center of rotation of the centrifuge to the location on the centrifuge arm that will provide the g level established for the test. Mount the test item so that its geometric center is at the location on the arm determined for the test load factor (g level). Calculate test levels as follows:

$$N_T = K\, r\, n^2$$

Where: N_T = test load factor (load factor normal to the centrifuge plane of rotation)
K = 1.118×10^{-3}, r in meters ($K = 2.480 \times 10^{-5}$, r in inches)
r = radial distance in meters, (inches) from the center of rotation to the mounting location on centrifuge arm
n = angular velocity of centrifuge arm in revolutions per minute (rpm)

Step 2. Orient the test item on the centrifuge for the six test direction conventions as follows:

(a) Fore. Front or forward end of test item facing toward center of centrifuge.

(b) Aft. Reverse the test item 180 degrees from fore position.

(c) Up. Top of test item facing toward center of centrifuge.

(d) Down. Reverse item 180 degrees from up position.

(e) Lateral left. Left side of test item facing toward center of centrifuge.

(f) Lateral right. Right side of test item facing toward center of centrifuge.

Step 3. After the test item is properly oriented and mounted on the centrifuge, make measurements and calculations to ensure the end of the test item nearest to the center of the centrifuge will be subjected to no less than 90 percent of the g level established for the test. If the g level is found to be less than 90 percent of the established g level, either mount the test item further out on the centrifuge arm and adjust the rotational speed accordingly, or use a larger centrifuge to ensure the end of the test item nearest to the center of the centrifuge is subjected to at least 90 percent of the established g level. However, do not subject the opposite end of the test item (the end farthest from the center of the centrifuge) to over 110 percent of the established g level. For large test items, consider exceptions for load gradients based on the existing availability of large centrifuges in commercial or government test facilities.

b. Track/rocket-powered-sled mounting. For track/rocket-powered-sled mounting, mount the test item and associated test fixture or apparatus on the sled platform in accordance with the controlled acceleration direction of the sled. (Ensure the test fixture or apparatus has been designed to isolate sled vibrations from the test item.) Since the sled and test item experience the same g levels, only the orientation of the test item on the sled is critical. Orient the test item on the sled according to the acceleration directions shown on figure 513.5-1 and the controlled acceleration direction of the sled for the six test directions.

4.4.2 Procedure I - Structural Test.

Step 1. Install the test item and place it in its operational mode and orientation as in paragraph 4.4.1.2.

Step 2. Bring the centrifuge to the speed required to induce the specified g level in the test item as determined from paragraph 2.3 and table 513.5-I for the particular test item orientation. Maintain this g level for at least one minute after the centrifuge rpm has stabilized.

Step 3. Functionally test and inspect the test item as specified in paragraph 4.4.1.1.

Step 4. Repeat this test procedure for the remaining five test directions noted in paragraph 4.4.1.2.a, Step 2.

Step 5. Upon completing the tests in the six test directions, functionally test and inspect the test item as specified in paragraph 4.4.1.1.

4.4.3 Procedure II - Operational Test.

4.4.3.1 Centrifuge.

Step 1. Install the test item and place it in its operational mode and orientation as in paragraph 4.4.1.2.

Step 2. Functionally test and inspect the test item as specified in paragraph 4.4.1.1.

Step 3. With the test item operating, bring the centrifuge to the speed required to induce specified g level in the test item as determined from paragraph 2.3 and table 513.5-II for the particular test item orientation. Maintain this g level for at least one minute after the centrifuge rpm has stabilized. Conduct a performance check and document the results.

Step 4. Stop the centrifuge and inspect the test item as specified in paragraph 4.4.1.1.

Step 5. Repeat Steps 1-3 for the five remaining orientations noted in paragraph 4.4.1.2.a, Step 2.

Step 6. Upon completing the tests in the six test directions, functionally check and inspect the test item according to paragraph 4.4.1.1.

4.4.3.2 Track/rocket-powered-sled.

Step 1. Install the test item and place it in its operational mode and orientation as in paragraph 4.4.1.2.

Step 2. Functionally test and inspect the test item as specified in paragraph 4.4.1.1.

Step 3. With the test item operating, accelerate the sled to the level required to induce the specified g level in the test item as determined from paragraph 2.3 and table 513.5-II for the particular test item orientation. Conduct a performance check while the test item is subjected to the specified g level. Document the results.

Step 4. Evaluate test run parameters and determine if the required test accelerations were achieved. Repeat the test run as necessary to demonstrate acceptable performance of the test item while under required test acceleration. Document test run parameters.

Step 5. Repeat this test procedure for the five remaining test directions noted in paragraph 4.4.1.2.a, Step 2. Upon completing the tests in the six test directions, functionally check and inspect the test item according to paragraph 4.4.1.1.

4.4.4 Procedure III - Crash Safety Test.

Step 1. Install the test item and place it in its operational mode and orientation as in paragraph 4.4.1.2.

Step 2. Bring the centrifuge to the speed required to induce the specified g level in the test item as determined from paragraph 2.3 and table 513.5-III for the particular test item orientation. Maintain this g level for at least one minute after the centrifuge rpm has stabilized.

Step 3. Inspect the test item as specified in paragraph 4.4.1.1.
Step 4. Repeat this test procedure for the remaining five test directions noted in paragraph 4.4.1.2.a Step 2.
Step 5. Upon completing the tests in the six test directions inspect the test item as specified in paragraph 4.4.1.1.

5. ANALYSIS OF RESULTS.

5.1 General.

Refer to the guidance in Part One, paragraphs 5.14 and 517, and to Part One, Annex A, Tasks 405 and 406.

5.2 Specific to this Method.

5.2.1 Structural test.

A test is successful if the test item is undamaged and fully functional at test completion.

5.2.2 Operational test.

A test is successful if the test item is fully functional at test accelerations and is undamaged and fully functional at test completion.

5.2.3 Crash safety test.

A test is successful if the test item remains structurally attached to the mounts and no parts, pieces, or contents are detached from the item at test completion.

6. REFERENCE/RELATED DOCUMENTS.

a. Junker, V.J., The Evolution of USAF Environmental Testing. October 1965; AFFDL TR 65-197; DTIC No. AD 625543.

b. Handbook for Dynamic Data Acquisition and Analysis, IES-RP-DTE012.1, Institute of Environmental Sciences, 940 East Northwest Highway, Mount Prospect, Illinois 60056.

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